

Common Skate and Tope: First Results of Glasgow Museum's Tagging Study

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Tagging, followed by release and recapture, has long been used to investigate the longevity, growth-rates and migratory routes of fish and it also provides data on the number of days at liberty, on minimum distances travelled and on directions of movement. In 1974, D.L. Burkel began a tagging programme to investigate two elasmobranch species found off the west coast of Scotland: Common Skate, *Raja batis* (L.), the largest N. Atlantic ray, and Tope, *Galeorhinus galeus* (L.), a small shark. The biology of these species has been little studied although both are vulnerable to over-fishing (Brander, 1981; Earl, 1992).

Common Skate are large bottom-living fish which frequent the N.E. Atlantic from the Straits of Gibraltar and the W. Mediterranean in the south to Norway, Iceland and the Faroes in the north. Normally found in deep water, Skate are predatory, feeding mainly on bottom-living fish, crustaceans and molluscs. They are extremely effective hunters, despite their bulk and shape, and some very active prey species are taken. They can grow to huge sizes, with specimens over 3m long, 2m across the wings and 200kg in weight having been caught commercially.

Common Skate are oviparous, laying on average 40 eggs at a time (they do not breed every year) and these hatch in 2-5 months depending on temperature. Formerly it was believed that most, if not all, Skate move offshore in winter (Wheeler, 1969); however commercial boats still catch them, albeit in reduced quantities, in inshore waters during the winter. It has also been assumed that, because of their shape and bottom-living habits, they remain in the same area throughout their lives. Stephen (1929), however, suggested that some individuals may make long migrations.

Tope frequent the N.E. Atlantic from the Canary Isles and the Azores in the south, through all parts of the Mediterranean to Norway and (rarely) Iceland in the north. They are generally found in shallow water (up to 55m) and feed mainly on bottom-living fish. They can grow to a length of 2m and a maximum weight of 45kg. Viviparous, they give birth to 20-30 live young during the warmer months.

Most Tope remain within British and Irish waters throughout the year but some make long coastal migrations, with tagged fish turning up off the Azores, the Canary Isles, Algeria, Morocco and the Iberian Peninsula. The discovery that at least some make long migrations was not unexpected - their closest relatives, the School Shark, *G. australis* from Australian waters (Olsen, 1954) and the Soupfin Shark, *G. zyopterus*, from the W. coast of the U.S.A. (Ripley, 1946), show similar behaviour. However, commercial Tope catches show that they arrive in northern waters in September, not from the south, but from a westerly direction. This is deduced from the fact that the first catches are made off N.W. Scotland and are followed by a gradual increase in numbers in the east until they peak in October to November before withdrawing to deeper water in January (Rae & Wilson, 1956). If it was a straightforward north-south migration then the fish would surely come up the east coast as well, arriving at approximately the same time as the west coast fish.

Materials and methods

Fish were tagged by anglers at 3 locations: the Isle of Mull, the Mull of Galloway and the Isle of Lewis (Stornoway). On capture they were weighed, measured, sexed, tagged and released and the location, depth and date was recorded against each tag number. Initially, JUMBO ROTOTAGS (normally used for ear-tagging livestock) were used, but their large size resulted in barnacle encrustation which caused abrasion of the fishes' skin. This problem was more important on Tope than on Skate (apparently because the latter tend to rub off the barnacles during bottom feeding) so it was decided to suspend Tope tagging during 1980. In the late 1980s it was realised that these tags damaged the wings of Skate during growth, so in 1988 they were replaced by the FLOY FT-1 DART TAG which, being a flexible plastic tube anchored in the fin musculature at one end only, allowed unrestricted growth. Also the small size and lack of flat surfaces of these tags minimised barnacle encrustation so that Tope tagging could be resumed.

Results and discussion

Common Skate

Between 1975 and 1988, 219 Skate were tagged using JUMBO ROTOTAGS. Seven were tagged by Stornoway Sea Angling Club at the Shiant Bank between March 1975 and February 1976 and the remaining 212 were tagged between August 1975 and December 1988 by Brian Swinbanks out of Tobermory.

Relatively few small fish (of either sex) were taken and this was a result of the angling technique. To ensure that the anglers had a good chance of catching large specimens, most angling was done offshore, well away from any breeding/ nursery areas. Also, very large baits were used to attract the bigger Skate and to deter smaller fish such as dogfish.

Recapture sites are shown in Fig. 1. Of the 219 fish tagged and released, 61 were recaptured by 31 December 1992, a recapture rate of 27.9%. One fish was recaptured 3 times and 9 were recaptured twice, making a total of 72 recaptures. Of the 61 fish recaptured, 16 were caught by commercial boats with 14 of them being killed and 2 being re-released. All other recaptures were made by Brian Swinbanks with the fish being re-released. None of the Stornoway fish reappeared.

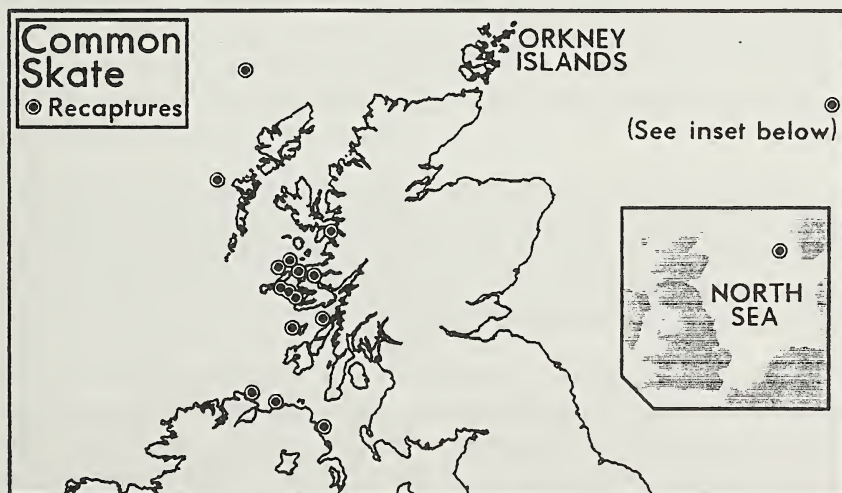


Figure 1: Recapture sites for tagged Common Skate in British and Irish coastal waters.

Of the 72 recaptures, 54 (75%) fish were caught at or near the release site and 89% of these were taken by Brian Swinbanks' boat from which they had been originally tagged. The periods of liberty of these ranged from 1 hour 20 minutes at one extreme to 4486 days at the other. A further 10 (14%) were taken within 70km of the release site, having been at liberty for between 205 and 1736 days. Five fish (7%) were taken between 70 and 200km from the tagging site: No. 263 was recaptured almost 10km south of Haskier Is., N. Uist, after 988 days; No. 643 was found in a consignment of fish in N. Ireland after 898 days; No.566 was taken off N. Ireland, near Greencastle, County Donegal, in June 1983, having been tagged off Mull in 1979; No. 728 was recovered in the N. Channel after approximately 2172 days and No. 537 reappeared in the Firth of Lorne after 1190 days.

Two fish made very long northerly journeys. No. 697 turned up 240km away, N.W. of Lewis after 581 days and of particular interest, the other, No. 729 tagged in July 1985, reappeared in November 1990, 900km away from its release point and 130km off S.W. Norway.

Of the Skate which travelled north, the month of recapture is known for 5. These were mature fish, of both sexes and all were commercially caught. Four were recaptured between January and April and one was caught in November. Much more intensive tagging would be required to explain these extended northerly migrations - possibly after moving offshore during winter some fail to return to the original location ("accidental displacement") or possibly some follow the edges of the continental shelf. They may also intercept and follow the spawning migrations of Hake from the N. Atlantic to the N. Sea as suggested by Ritchie (1923).

Recapture dates are known for each of the 3 skate which travelled south. All were recovered off the north and east coasts of Northern Ireland between March and June and, like those which headed north, were a mixture of mature males and females. Again this may have simply been caused by "accidental displacement".

These results support a hypothesis that individual Skate may be associated either permanently or seasonally with specific sites for long periods, but give no information on possible seasonal migrations. The angling effort is from May to October and all the commercial recaptures in the Mull area occurred in the second half of the year. The data

therefore probably reflect the intensity of fishing at different times of the year rather than the availability of fish. It may be noted, however, that 3 Skate were captured off Stornoway in February and March at depths of between 42 and 64m. This does not support the theory that Skate migrate "en masse" to deep water in winter.

The suggestion of Stephen (1929) that some Skate make long migrations seems amply supported.

The sex-ratio of catches off Mull was roughly 1:1 (97 males/ 104 females) and, as most recaptures were made over the same grounds, the recapture rate was very similar (25/ 31). The data, therefore, provide no definite evidence that Skate gather in single sex shoals although there is some circumstantial evidence for this. For example, 5 Skate were tagged on 13 June 1977. The first was an immature female; an hour and a quarter later what appeared to be a different group of immature males passed through, with two being captured within 15 minutes; just under two hours later, another group of mature females arrived with two being taken within 20 minutes.

In common with most elasmobranchs, Common Skate are long-lived but slow-growing. According to Du Buit (1977), it takes them approximately 11 years to reach sexual maturity. Fig. 2 shows the annual weight increases for specimens tagged between 1977 and 1988 along with their subsequent recaptures up to 31 December 1992, and Fig. 3 shows the weight distribution for all male and female Skate tagged plus their recapture weights.

Clearly, males grow more slowly than females, increasing by from 2.7 to 9.1kg per year with an average of from 3.2 to 4.5kg. and, with most, growth slows down or stops when they reach around 50 to 54kg. Their normal maximum weight appears to be from 52 to 54kg with only an occasional specimen reaching 61kg.

Females, however, grow much more rapidly, adding from 4.1 to 14.1kg per year (average from 5.4 to 8.2kg.) and only two of those tagged and recaptured showed any signs of decelerated growth. The heaviest specimen taken in the present work weighed 103kg.

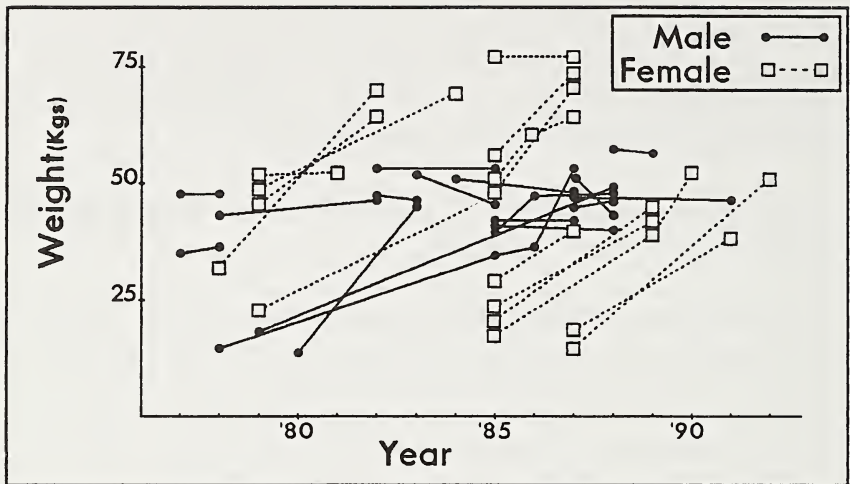


Figure 2: Growth rates for tagged and recaptured Common Skate.

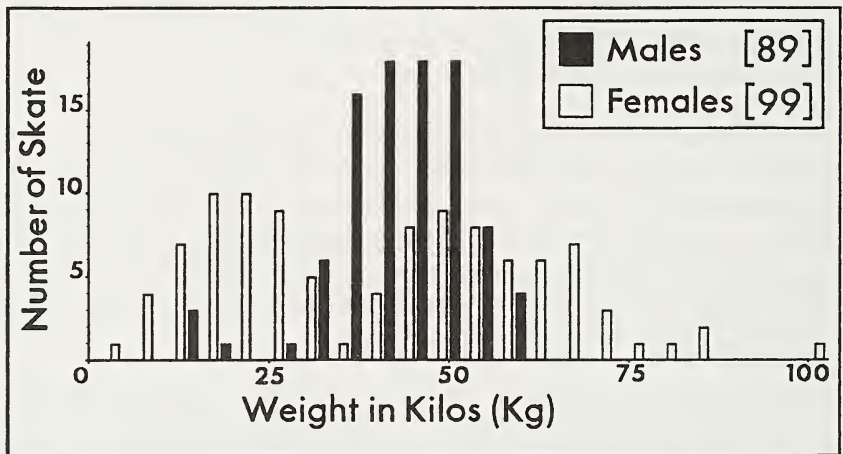


Figure 3: Weight frequencies of individual Common Skate, by sex.

An estimate of longevity can be made from the longest period of freedom observed. No. 659, a female, was tagged in August 1980 and was recaptured in November 1992 after approximately 4486 days (12.3 years). This fish originally weighed 17.3kg and at that time would have been at least 5 years old, giving an age at the time of its demise of 17+ years. A life span in excess of 20 years therefore seems reasonable.

One Skate, No.764, released off Mull, was subsequently recaptured in a trawl and re-released only to be recaptured again by Brian Swinbanks at the original release site. This is of interest, because it shows that "commercially unwanted" Skate returned to the sea can survive, even after the trauma of being caught in a trawl.

Tope

Between mid-1974 and September 1980, 64 Tope were tagged using JUMBO ROTOTAGS. Twenty-two were tagged by Dr. Burkel and associates in the Mull of Galloway area between 1974 and 1977 and the remaining 42 were tagged between 1975 and 1980 by Brian Swinbanks at Tobermory. The results obtained provided the only currently available data for Scottish waters.

Of the 64 fish tagged and released, 12 were subsequently recaptured by 31 December 1992. This represents a recapture rate of 18.7% which is comparable with the results of Stevens (1990) which had a 15% return rate. Such high recapture rates can be expected in tagging studies of localised shark populations according to Davis & Joubert (1967) and Kato & Carvalho (1967). Of the recaptures, 7 were originally released off the Mull of Galloway and the remaining 5 off Mull.

Only one fish, No.201, turned up in the area of its original release, west of Mull, after being at liberty for 765 days. Of the remainder, 4 (Nos. 182, 555, 581 & 582) were recaptured off the north and west coasts of Ireland between April and October, between 220 and 500km from the release sites after periods of from 79 to 926 days. A further 2 were taken off west Wales (No.620) and north Cornwall (No.186), in January and November - an average movement of 420km. Two more (Nos. 143 & 281) were recaptured in the English Channel, in January and October, a movement of approximately 800km. One of these was tagged around 1977 in Luce Bay and it reappeared off Hastings in January 1990, having been at liberty for about 12 years.

Three fish, originally released near the Mull of Galloway, made long southerly migrations: No.189 to Lisbon (1800km) in approximately 62 days; No.192 to Feurteventura, Canary Isles (3000km) after 268 days and No.171 to West Tipasa, Algeria (3200km) after approximately 9 years (Fig.4).

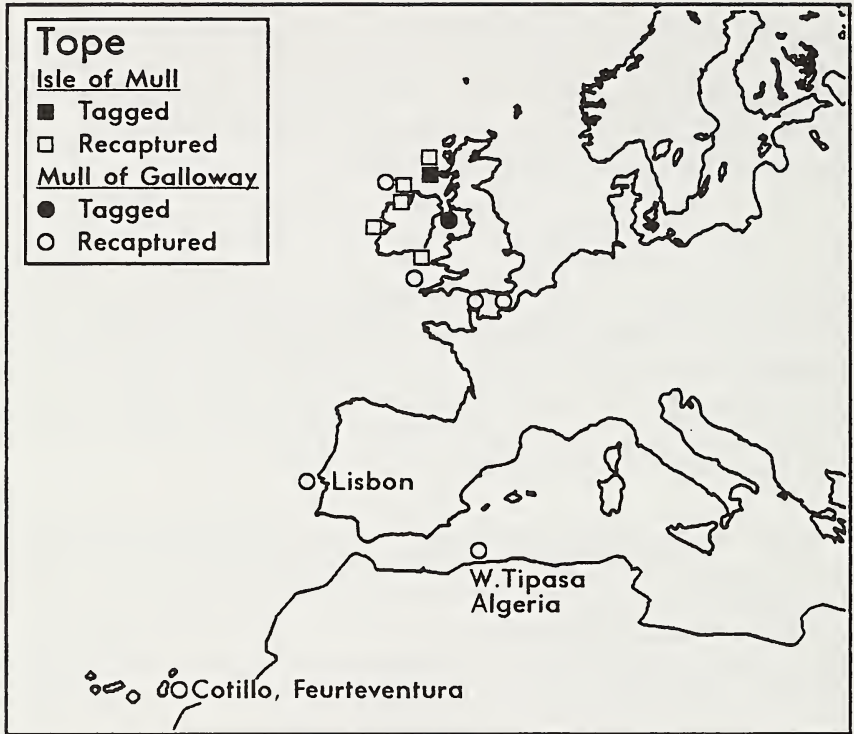


Figure 4: Recapture sites for tagged Tope in the North-East Atlantic.

In common with the findings of Holden & Horrod (1979) and of Stevens (1990) the results do not show any evidence of a mass migration of Tope to the south in winter. If that were the case then Fig. 5(B) would show that the majority of fish recaptured north of latitude 45°N (i.e. about the middle of the Bay of Biscay) were made between May and September and south between October and April. However, this was not so.

The greatest numbers of recaptures south of 45°N were made in April and May and are possibly part of a migration of pregnant females heading for the pupping areas. There is no evidence supporting the assertion that Tope regularly breed in British inshore waters. Newly born "pups" measure approximately 35cm long and, although they are recorded in British waters, their occurrence is extremely rare. While working long lines off Galloway, the author never saw a Tope smaller than about 90cm.

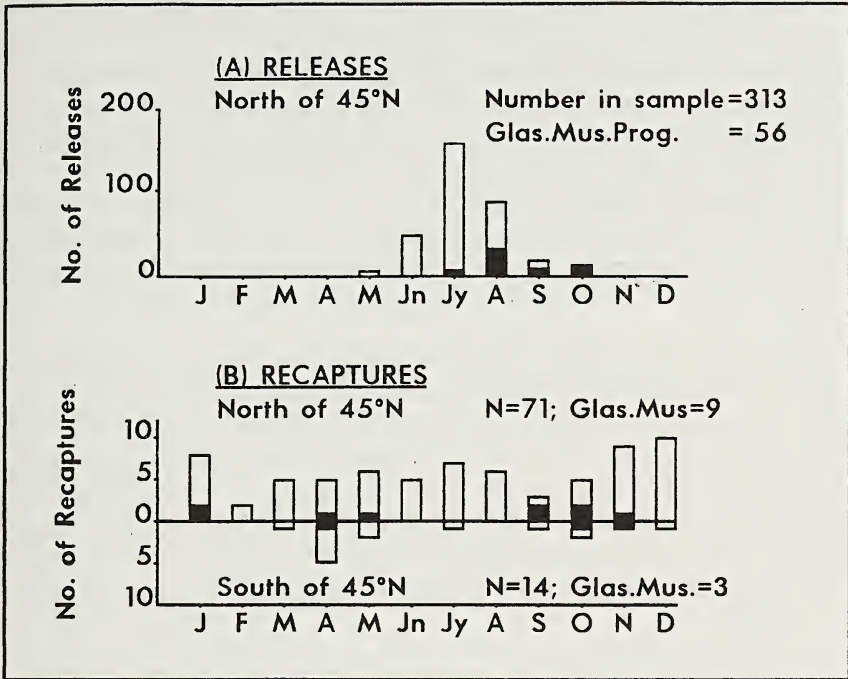


Figure 5: Month of release and recaptures of tagged Tope, by latitude. (A) Releases north of 45 degrees N. (B) Recaptures north and south of 45 degrees N. Black shaded areas represent Glasgow Museums' tagging programme. Unshaded areas represent data from Holden & Horrod (1979) and Stevens (1990).

Out of the 12 recaptures, 3 made long distance journeys south of 45°N. All of these were tagged off Galloway and at least one was female. None of the many males tagged off Mull moved very far south, the furthest travelled being recaptured off the Pembroke coast. Possibly long migrations are made only by females which leave the cooler northern waters in autumn of one year in preparation for "pupping" in warmer waters during the following spring/ summer. Such migrations can be rapid: one fish tagged off Galloway in August 1974 was found at Lisbon 62 days later, having travelled 1800km at an average speed of about 29km/day. This pattern of behaviour seems similar to that of the closely related *G. zyopterus*, of N. American waters, in which, during the breeding period, May to July, large numbers of females congregate in southern Californian waters where the pupping areas occur (Ripley, 1946).

Fitzmaurice (1979) suggested that Tope produce young every other year after a gestation period of approximately one year. This could explain the presence of a mature female, No.182, west of Donegal in April, since she could have been in a non-breeding year. Fitzmaurice also suggested that, on reaching a certain stage in their life history, Tope could migrate southwards and not return. However if this were true, then they would be caught only up to a certain size in British waters. On the contrary, fish weighing up to 45kg have been taken commercially here, this weight being close to the maximum for the species.

There were interesting differences in the sex ratios amongst the Tope catches at the two tagging sites. Off Galloway, males made up 29% of the catch (where sex was recorded) whereas to the West of Mull, males made up 90% of those tagged. This difference was probably exaggerated because of the style of angling off Mull. Here most Tope were captured whilst anglers were pursuing Skate in deep water offshore. The author's experience off Galloway showed that females prefer shallower water inshore, whereas males occur in greater numbers offshore.

Studies on the related *G. zyopterus* (Ripley, 1946) and *G. australis* (Olsen, 1954) suggest that Tope may be long-lived and slow-growing. The limited data from the present programme support this hypothesis. Two fish, Nos.143 and 171 were at liberty for over 10 years but on recapture weighed only 11 and 18 kg respectively. The first of these figures may, however, be low, as this fish was caught commercially and this could be the "gutted" weight.

If it be assumed that when released, these fish weighed over 4.5kg (lighter fish are very rare in Galloway) then average growth rates would be 0.7 - 1.4kg/ year. Thus a female would take over 20 years to attain a weight of 27kg.

Amongst fish at liberty for shorter periods No.192, a female, increased in weight by 1.6kg (15.4 to 17.0) in 9 months and No.281, a sexually immature female, increased by 4.3kg (7.7 to 12.0) in 13 months. Possibly, like sexless "Triploid" rainbow trout used in fish farming, immature female Tope grow more quickly than mature ones because all the food intake goes towards growth rather than to reproduction.

One male, No.201, increased by 1.4kg in just over 2 years.

Since 1989 tagging has continued with Floy Tags allowing a further 230 Common Skate and 44 Tope to be tagged. Sponsorship from the Angling Foundation, Deep Sea World, and Knotless Fishing Tackle (Tobermory) has allowed more tagging agents to be involved at more locations, enabling a more complete picture of fish movements to be constructed. It is hoped that the imbalance between the numbers of Skate and Tope tagged will be redressed in 1994 utilising the services of a professional "Tope" skipper in S.W. Scotland.

Anyone interested in helping with the tagging programme should contact Mr Richard Sutcliffe at the Art Gallery and Museum, Kelvin-grove, Glasgow G3 8AG.

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Book Reviews

The Complete Guide to Ireland's Birds.

ERIC DEMPSEY, art work by MICHAEL O'CLERY.
Gill & Macmillan, Dublin, 1993, 254pp., many colour drawings and photographs, maps. Hardback, ISBN 07171 1973 4, £14.99.

Listing in detail 310 common and 100 less common species of birds of Ireland, this book is informative. It highlights factors, such as Ireland's mild winters, which affect the success or otherwise of Irish bird life and it explores and maps habitats. Illustrations provide standard identification charts and there are useful field portraits of birds in their likely habitats.

This is a good, readily accessible, book and is a significant contribution to the history of Irish bird watching. A high level of research is very evident from its content and it is suitable for anyone interested in birds. The quick reference layout for each bird might usefully be copied by other authors.

BRIAN S. SKILLEN.

Seashores and Shallow Seas of Britain and Europe

ANDREW CAMPBELL, illustrated by JAMES NICHOLLS
Hamlyn, London, 1994, 320pp., many colour illustrations and line drawings, 1 map. Softback, ISBN 0 600 58376 7, £9.99.

This is an updated edition of the well-known and popular *Hamlyn Guide to Seashore Plants and Animals* first published in 1976. The new version closely resembles the earlier one but has undergone a slight change of title, has a newly designed cover and a revised ISBN number.

Names and references have been updated and the colour printing has been improved. The use of a better quality of paper and the provision of a plastic loose jacket gives the book a more attractive appearance and will make it more durable than its forerunner. At the bargain price of £9.99 it is still the best available production in its class.

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